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(54) Aseptic valve

(57) A valve, e.g. for sampling, connectable to a volume of primary fluid which is to be maintained aseptic or uncontaminated, comprises a valve element 5 movable between the illustrated first, operative position in which a conduit 6 therethrough communicates with the primary fluid and a second position in which the conduit 6 is sealed from the primary fluid by means of seal 20, and an internal volume 3a into which a purgative fluid can be introduced, the volume 3a being sealed from the primary fluid by seal 11 or seal 20. Within the valve, the conduit 6 and those surfaces between the seals 11, 20 which become exposed to the primary fluid on movement of the valve element 5 from the second position to the first are exposed to the interior of the volume 3a when the valve member is in the second position, whereby they can be rendered aseptic by passage of the purgative fluid through the volume 3a.

Fig. 1a

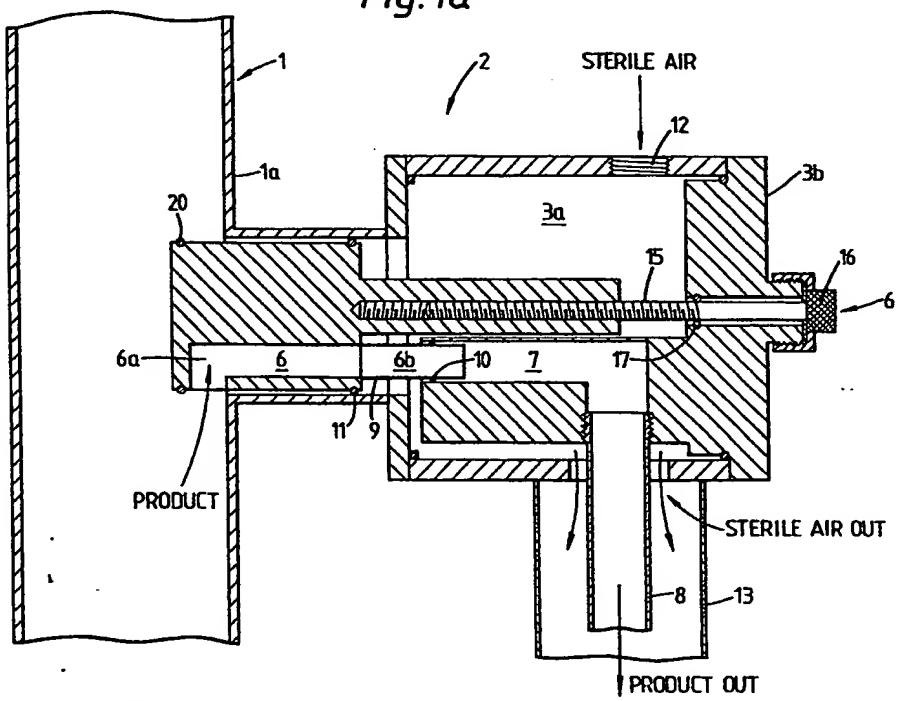

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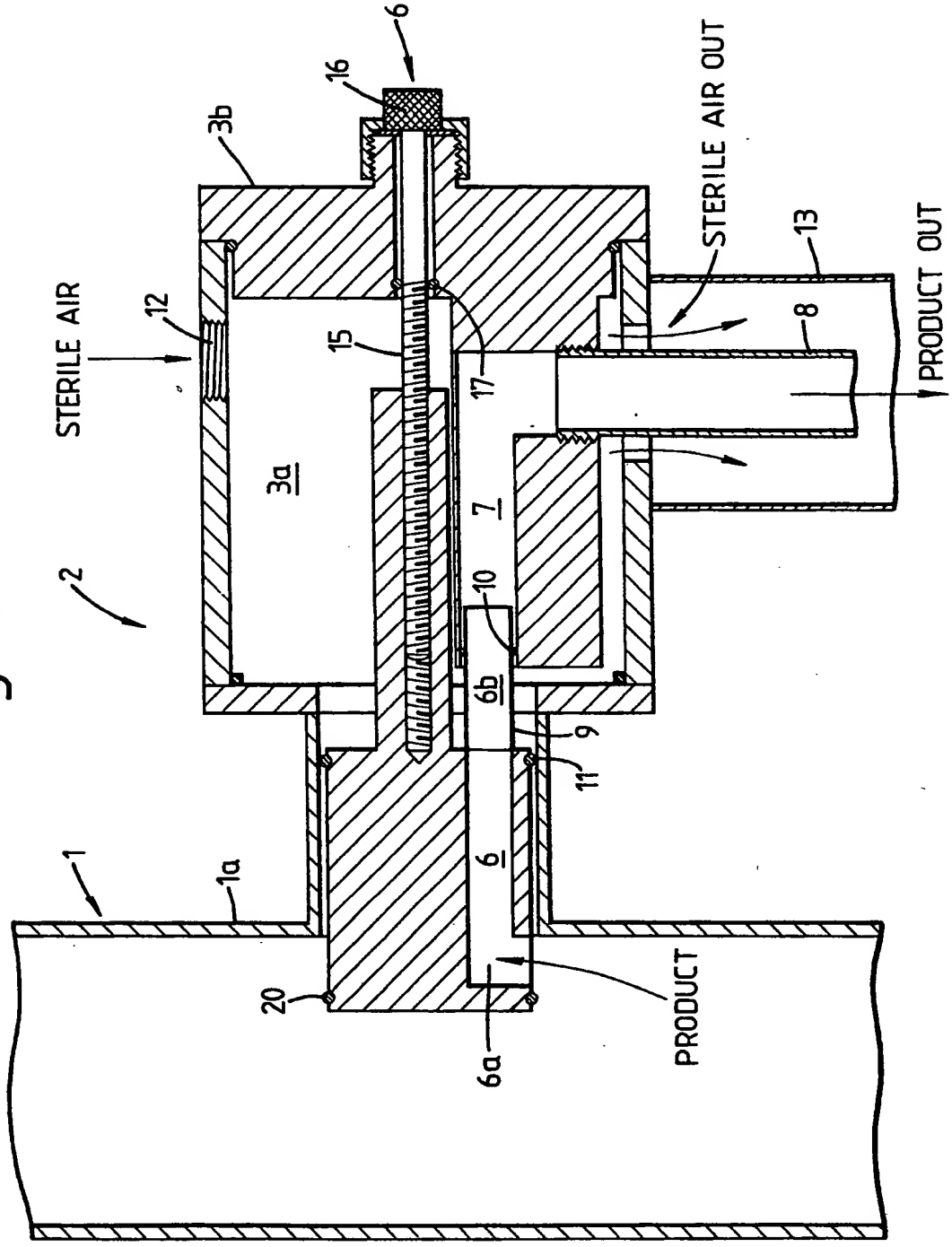
Fig. 1a



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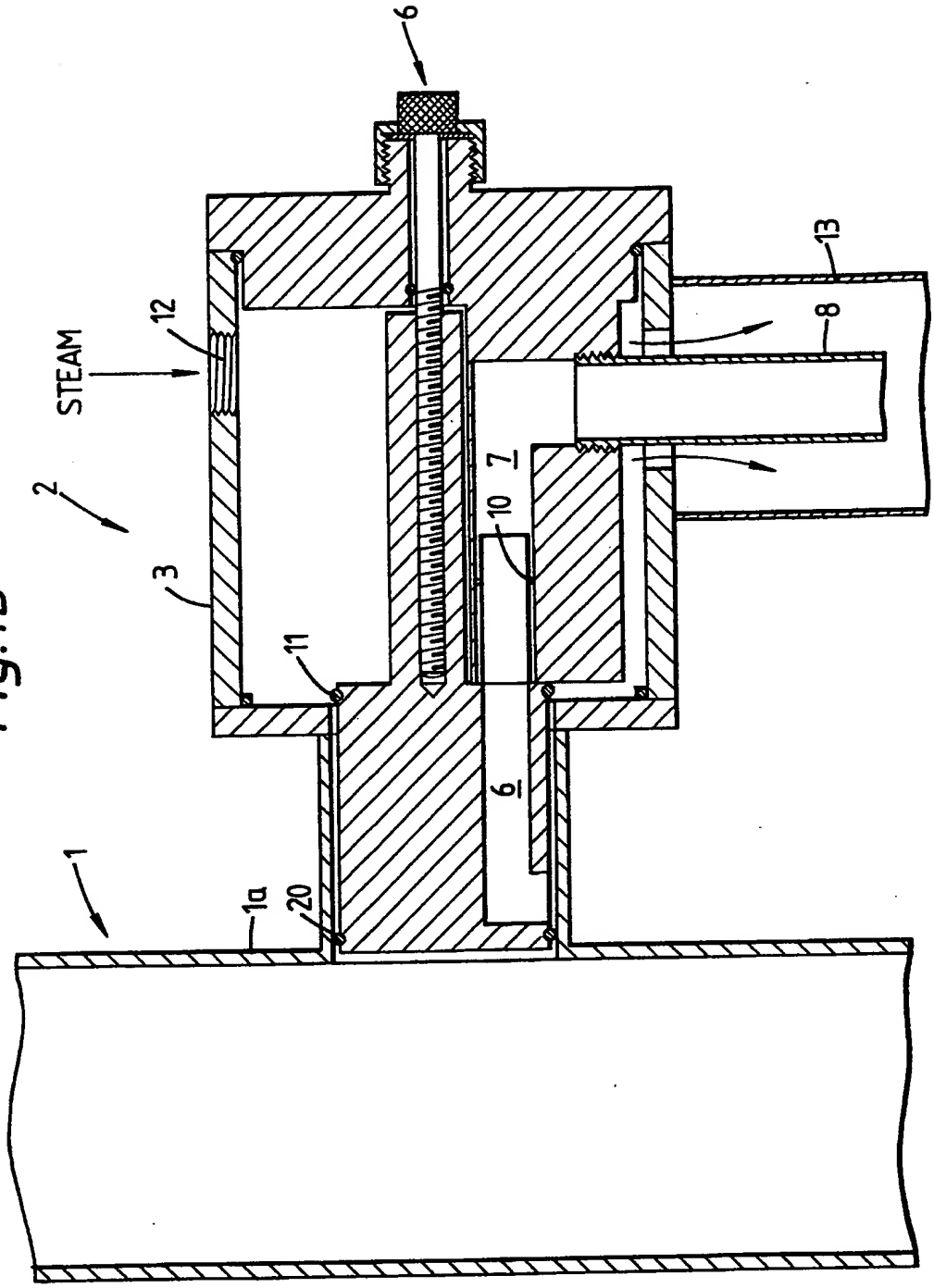

Fig.1b

ASEPTIC VALVE

The present invention relates to a valve for use in aseptic conditions.

There are many applications where it is desirable to sample a fluid, or to mix one fluid into another, under aseptic conditions so that the fluid remains uncontaminated. Examples include the food manufacturing and processing industries, the dairy, pharmaceutical and brewing industries and processes in biotechnology; others may be found in the chemical industry where toxic or explosive materials are encountered. Such mixing and sampling operations generally require movement of a valve element between two positions, or through a range of positions where a proportioning effect is required, and the difficulty can arise that with the majority of existing valve structures, this movement involves exposure to the primary fluid of surfaces of the valve which may not be aseptic. Sterilisation of those surfaces by introducing a sterilising agent into the volume normally occupied by the fluid may be incompatible with the purpose of the valve, as where it is used to communicate the fluid volume with the exterior of with a source of another fluid.

The present invention is intended to provide a valve for use in the above and any analogous applications which avoids the above described difficulty.

According to the present invention, there is provided a valve connectable to a volume of primary fluid which is to be maintained aseptic or uncontaminated, the valve comprising a valve member movable between a first, operative position and a second position and an internal volume into which a purgative fluid can be introduced, the volume being

sealed from th primary fluid, the arrangement being such that those surfaces which become exposed to the primary fluid on movement of the valve member from the second position to the first are exposed to the interior of the volume when the valve member is in the second position. Thus, with the valve in the second position, the surfaces which might otherwise contaminate the primary fluid can be sterilised or decontaminated by connecting the volume to a source of a purgative fluid appropriate to the application in question.

The invention will be further described by way of non-limitative example with reference to the accompanying drawings, in which:-

Figure 1a is a cross-sectional view of an embodiment of sampling valve according to the present invention, in the sampling position; and

Figure 1b is a view corresponding to figure 1a in the closed, sterilising position.

Referring to Figure 1a, this shows a conduit 1 through which the is a flow of a fluid product from which it is desired to extract a sample periodically without risk of contamination of the product. In food production, for example in the dairy industry, the product could be a liquid dairy product, and the purpose of taking the sample could be for quality or hygiene control or for analysis to control the process parameters.

In order to enable the required samples to be taken aseptically, a sampling valve 2 embodying the present invention is provided, conveniently in the form of a "Tee"-piece comprising a section of conduit 1a provided with couplings (not shown) to enable it to be connected into the conduit 1, and a sampling valve body 3 rigidly connected to

the conduit section 1a.

The valve body 3 has an interior volume 3a and comprises a cylindrical section 4 connected to the conduit section 1a. Within the section 4 is a sampling valve element 5 which is movable by means of an actuator 6, to be described below, between two limit positions, namely a sampling position as shown in Figure 1a and a second position as shown in Figure 1b in which the valve can be sterilised.

The valve element 5 has an "L"-shaped interior conduit 6 comprising a radially extending section 6a which communicates with the interior of the conduit 1a in the Figure 1a position, and a longitudinally extending section 6b which communicates with an "L"-shaped passage 7 defined in the valve body 3 leading to a sample-dispensing conduit 8. The downstream end of the passage 6b is constituted by a cylindrical extension 9 from the body of the valve element 5 which telescopes into the "foot" of the "L"-shaped passage 7. O-ring seals 10 and 11 on the extension 9 and valve element 5 ensure that there is no fluid communication between the interior of the conduit 1 and the interior 3a of the valve 3.

Throughout sampling, sterile air is injected into the interior volume 3a and exits via a conduit 13 coaxial with the sample dispensing conduit 8, forming a cylindrical curtain of sterile air isolating the conduit 8 from the exterior. The pressure in the volume 3a should be maintained above atmospheric pressure.

The sample fluid can be collected from the conduit 8 by any suitable aseptic means. For example the conduit 8 may be fitted with a needle similar to that of a hypodermic syringe and this needle may be used to pierce a flexible (e.g.

rubber) and self-res aling seal of a coll cting container. The container should be of a nature such that it can be filled aseptically, for example by being inflatable (so that there is no need to vent air displaced by the incoming sample) or be provided with an aseptic venting arrangement. As another alternative, the container could be initially evacuated under sterile conditions, similar to the manner of containers sometimes used for taking blood samples.

It will be apparent that although in the above, the valve is used to extract a sample aseptically from the conduit 1, it could equally well be used to inject aseptically a fluid (gas or liquid) into the conduit under aseptic conditions, for mixing or other purposes.

The valve 3 is sterilised prior to sampling by moving the valve element 5 to the position shown in Figure 1b by operation of the actuator 6. In the illustrated form, the actuator 6 comprises a threaded pin 15 mounted for rotation on the end plate 3b of the valve 3 and operable by means of a knurled nut 16; an O-ring 17 engaging the pin 15 maintains the interior 3a sealed.

The pin 17 is threadedly engaged with a threaded extension 18 on the valve element 5. It will be apparent that provided the valve element 5 is prevented from rotating with the pin 15, relative rotation of the two will cause the valve element 5 to move axially relative to the pin; in the illustrated embodiment this is achieved by the telescoped engagement of the extension 9 with the wall defining the passage 7, although any other suitable arrangement could equally well be used. Further the rotation of the pin 15 could be done by an electric, hydraulic or pneumatic motor or the pin 15 could be replaced by a linear electric, hydraulic or pneumatic motor. As an example of a pneumatic

motor, the valve element 5 could be connected to a flexible diaphragm move back and forth by a source of pressurised fluid.

The valve element 5 is provided at its lefthand end with a seal 20 which engages the inner wall of the section 5 when the valve element 5 is moved to the figure 1b position in order to maintain the interior volume 3a of the valve sealed from the interior of duct 1. It will be seen from Figure 1b that the distance between seals 11 and 20 is greater than the length of section 4, whereby once the seal 20 comes into sealing contact with the interior wall of the section 4 (thereby isolating the interior of the conduit 1 from the interior 3a of the valve 3), the seal 11 is moved clear of the interior wall of the section 4. This exposes that part of the periphery of the valve element 5 between the seals 11 and 20 (i.e. the part which becomes exposed to the interior of the conduit 1 in the sampling position) to become exposed to the interior 3a of the valve. In this condition, the inlet 12 can be connected to a source of a suitable purgative fluid such as pressurised steam so that the parts of the valve exposed to the interior volume 3a can be sterilised/decontaminated. In particular the surfaces of the valve which in the sampling position are exposed to the product in the conduit 1, namely the part of the outer periphery of the valve element 5 between the seals 11 and 20 and the interior passage 6 are, in the Figure 1b position exposed to the purgative fluid passing through the interior volume 3a. It will be apparent that in no position of the valve element 5 is the interior of the conduit 1 in communication with the interior 3a of the valve 3. Application of steam at 140°C and 30-35 psi for 15 minutes is sufficient to complete sterilisation. At the end of sterilisation, the supply of sterilised air is reconnected to cool the valve and to maintain positive internal

pr ssure.

A valve constructed in accordance with the invention may be used, inter alia, for the following purposes:-

a) Aseptic of fluid;

b) Micro adjustment for aseptic piston fillers;

c) Aseptic opening and closing valves for aseptic tanks;

d) Aseptic flow control valves; and

e) Aseptic mixing of two products or aeration.

CLAIMS

1. A valve connectable to a volume of primary fluid which is to be maintained aseptic or uncontaminated, the valve comprising a valve element movable between a first, operative position and a second position and an internal volume into which a purgative fluid can be introduced, the volume being sealed from the primary fluid, the arrangement being such that those surfaces of the valve which become exposed to the primary fluid on movement of the valve element from the second position to the first are exposed to the interior of the volume when the valve element is in the second position.

2. A valve according to claim 1, wherein the valve element is movable between the first and second positions within a section of said interior volume against whose wall it is sealed by first and second seals spaced longitudinally of the section and each extending around the periphery of the valve element, the positions of the seals on the valve element, the longitudinal spacing between the seals and the length of the section swept by movement of the valve element between the first and second positions being such that:-

a) in the first position of the valve element, the second seal maintains a seal between the primary fluid and the interior volume, with the region of the periphery of the valve element between the first and second seals and the first seal being exposed to the primary fluid; and

b) in the second position, the first seal maintains a seal between the primary fluid and interior volume, while the region of the periphery of the valve element between the first and second seals and the second seal are exposed to the interior volume.

3. A valve according to claim 1 or 2, wherein the valve element has a conduit extending therethrough, one end

of which is placed is communication with the primary fluid when the valve element is in the first position and is sealed from the primary fluid when the valve element is in the second position, and the other end of which communicates with a conduit leading away from the primary fluid to the exterior of the internal volume.

4. A valve according to claim 3, wherein a portion of the valve element is telescoped to the outlet conduit.

5. A valve according to any one of claims 1 to 4, wherein the interior is provided with an inlet and an outlet for the secondary fluid.

6. A valve according to claim 5 and claim 3 or 4, wherein the secondary fluid outlet provides a curtain of secondary fluid surrounding the end of the outlet conduit remote from the valve element.

7. A valve according to any one of the preceding claims, wherein the valve element is threadedly engaged with a rotatable shaft and is constrained against rotation with it, whereby rotation of the shaft will cause movement of the valve element between the first and second positions.

8. A valve according to claim 7 and any one of claims 3 to 6, wherein the valve element is constrained against rotation by its engagement with the outlet conduit.

9. A valve constructed and arranged to operate substantially as hereinbefore described with reference to the accompanying drawings.

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